

## Popular Abstract

**Heading:** Deep-learning-driven augmentation of a computed tomography database with synthetic metal artifacts.

**Introduction:** A CT database was enriched with synthetic metal artefacts using custom 3D implants of various designs and attenuation properties. The aim is to improve the robustness of deep-learning algorithms.

**Main text:** CT-scanning is a major imaging technique widely utilized in the clinical field on a daily basis. This technique provides valuable information, including the structure and shape of bones, which is crucial for advanced diagnostics and surgical planning. The process of extracting tissue structures from CT scans is known as segmentation and relies on efficient technologies like deep-learning algorithms to achieve rapid and precise segmentation results. However, challenges arise when metal objects, such as implants, are present within the CT-scanned area.

These metal objects cause significant image distortions and noise, commonly referred to as artefacts. These artefacts substantially degrade image quality and complicate the segmentation process due to the presence of intense dark and bright streaks that overlay the tissue structures.

Consequently, this thesis was dedicated to developing a pipeline that focuses on robust artefact-handling algorithms based on deep-learning networks. CT scans were collected, and synthetic artefacts were simulated using MATLAB programming environment. The artefact simulation process provides a versatile framework with adjustable parameters for generating artefacts of various shapes and intensities. This simulation framework serves as a valuable tool for potentially training a deep-learning network.

The simulator exhibited remarkable capability in generating realistic artefacts, encompassing complex shapes and intensities. Consequently, constitutes a rich input for the deep-learning algorithm to accurately segment bones from clinical cases that feature real artefacts.